
UNIVERSITI PUTRA MALAYSIA

# DEVELOPMENT OF GSM-BASED VEHICLE ANTI-THEFT SYSTEM

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# DEVELOPMENT OF GSM-BASED VEHICLE ANTI-THEFT SYSTEM

**By**

**KHAIRUL HAMZANI BIN HAMID**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia in Fulfilment of the Requirement for the Degree of Master of Science**

**March 2006**

*Dedicated to my parents,*
*Allahyarham Hj. Hamid Bin Abd Rahman and Hjh. Ashkah@ Zamzani Bt Awang*

*My dearest brothers,*
*Nizam, Badrul, Yusri and Azizi*

*My beloved wife,*
*Juhaini Bt. Hj. Saif*
*and*

*friends….*

*……with love……*

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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**Chairman : Associate Professor Ishak bin Aris, PhD**

**Faculty : Engineering**

Vehicle theft is a universal problem. The statistic of the vehicle gets stolen or vandalized increases at an alarming rate every year. For example in Malaysia alone, for the year 2004, it was reported that about 26,566 cars were stolen which represents about 33% increases compared to the statistic of the same period of the previous year. This will lead to an increase in the vehicle insurance premium which has to be paid by consumers. Therefore, it can be concluded that the security systems installed by the vehicle manufacturer are not effective enough.

To solve this problem, a wireless vehicle security system which implements mobile communication protocol is proposed. The control and communication between the user and the proposed system are achieved through a short message services (SMS) protocol available in the cellular phone. The proposed system is interfaced with an immobilizer and a remote keyless entry system.

The proposed system is capable of informing the user through the user's cellular phone if the car is vandalized, tampered or stolen by an intruder. At the same time the remote keyless entry system and the immobilizer systems will activate the alarm. The system will produce human voice instead of producing an alarm sound. By using the proposed system, the user is also capable of controlling the car's door remotely. The effective communication coverage of this system is based on the user's cellular phone coverage. The proposed system consists both hardware and software parts. The hardware components include a microcontroller, an immobilizer, a remote keyless entry (RKE) system, a GSM modem, a voiced-alarm module, a cellular phone and a remote control of the RKE system. The software part includes a program controller interface. The result of simulation and practical tests conducted on the proposed system, demonstrate that the proposed system is successfully designed and fabricated.

Abstrak tesis dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**PEMBANGUNAN SISTEM BERASASKAN GSM UNTUK KESELAMATAN KENDERAAN**

Oleh

**KHAIRUL HAMZANI BIN HAMID**

**Mac 2006**

**Pengerusi : Profesor Madya Ishak bin Aris, PhD**

**Fakulti : Kejuruteraan**

Kecurian kereta merupakan masalah universal. Statistik kecurian atau pencerobohan kereta makin meningkat ke tahap yang membimbangkan. Sebagai contoh di Malaysia, bagi lapan bulan yang pertama untuk tahun 2004, lebih kurang 26,566 buah kereta dilaporkan telah dicuri dan angka ini mewakili 33% peningkatan berbanding dengan waktu yang sama pada tahun sebelumnya. Ini secara tidak langsung boleh mengakibatkan peningkatan terhadap premium insuran yang perlu dibayar bagi pengguna. Dengan itu, sistem keselamatan yang dipasang oleh pengeluar kenderaan masih tidak cukup berkesan.

Kaedah untuk mengatasi permasalahan ini adalah dengan penggunaan sistem keselamatan kenderaan tanpa wayar di mana penggunaan protokol komunikasi dicadangkan. Pengawalan dan komunikasi di antara pengguna kepada sistem yang dicadangkan dapat dicapai dengan menggunakan protokol khidmat pesanan ringkas (SMS). Sistem yang dicadangkan telah digabungkan dengan sistem pelumpuh dan sistem masuk tanpa kunci kawalan jauh.

Sistem yang dicadangkan berkebolehan untuk memberitahu pengguna melalui telefon mudah alih sekiranya kereta mereka dicerobohi, dipecah masuk ataupun telah dicuri. Pada masa yang sama sistem masuk tanpa kunci jarak jauh dan sistem pelumpuh akan mengaktifkan bunyi amaran. Sistem ini menggunakan suara manusia berbanding siren amaran seperti yang selalu digunakan. Dengan menggunakan sistem yang dicadangkan, pengguna dapat mengawal pintu kereta secara kawalan jauh. Tahap keberkesanan liputan komunikasi sistem ini bergantung kepada tahap liputan telefon mudah alih pengguna tersebut. Sistem yang dicadangkan meliputi bahagian perkakasan dan perisian. Bahagian perkakasan adalah pengawalmikro, sistem pelumpuh, sistem masuk tanpa kunci jarak jauh, modem GSM, modul penggera suara, telefon mudah alih dan kawalan jauh bagi sistem masuk tanpa kunci jauh. Bahagian perisian adalah bahagian program kawalan antara muka. Simulasi dan ujian praktikal telah dijalankan kepada projek yang dicadangkan. Secara keseluruhannya, dari segi rekaan dan pemasangan terhadap sistem yang dicadangkan telah berjaya dilaksanakan.

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I certify that an Examination Committee has met on 22nd March 2006 to conduct the final examination of Khairul Hamzani Bin Hamid on his Master of Science thesis entitled "Development of GSM-Based Vehicle Anti-Theft System" in accordance with Universiti Pertanian Malaysia (Higher Degree ) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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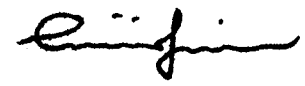

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## DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

**KHAIRUL HAMZANI BIN HAMID**

Date : 12 JULY 2006

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| | |
|---|---|
| CID | Customer Identification Device |
| CMOS | Complementary Metal-Oxide Semiconductor |
| CPU | Central Processing Unit |
| DDR | Data Direction Register |
| EEPROM | Electrically Erasable Programmable Read-Only Memory |
| ETSI | European Telecommunication Standards Institution |
| Gnd | Ground |
| GPS | Global Positioning System |
| GSM | Global System for Mobile Communication |
| I/O | Input/Output |
| ICP | On-chip in-system Programmable |
| IDE | Integrated Development Environment |
| LCD | Liquid Crystal Display |
| LED | Light Emitting Diodes |
| MMS | Multimedia Message Services |
| PC | Personal Computer |
| PIAM | General Insurance Association of Malaysia |
| PKE | Passive Keyless Entry |
| PWM | Pulse-width-modulation |
| RF | Radio Frequency |
| RKE | Remote Keyless Entry |
| SIM | Subscriber Identity Module |
| SMSC | Short Message Service Centre |

| | |
|---|---|
| SMS | Short Message Service |
| SPI | Serial Peripheral Interface |
| UART | Universal Asynchronous Receiver / Transmitter |
| UK | United Kingdom |

# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

The crime statistical data shows that thefts of vehicle, especially car are increasing dramatically around the world. This upward trend has started to increase rapidly and reaching an alarming proportions particularly in Europe and the rest of the world for the past few years. New guidelines driven by the insurance companies are being set for vehicle manufacturers to make their products more secure [1].

In Malaysia, many cases of vehicle theft have been reported. The number is increasing every year. According to the General Insurance Association of Malaysia (PIAM), the statistic of the car theft for year 2003 shows that the highest number of car theft happened in urban areas such as Kuala Lumpur and Shah Alam, Selangor. Furthermore the car theft rate increases at the rate of about 10 to 20% yearly [2].

## 1.2 Problem statement

Based on the discussion and data related to stolen cars, it is observed that the car theft is a global problem. Nobody likes his or her car to get stolen. The insurance companies also feel the pressure as they have to pay the claims made by the customers. As a result, the insurance companies have to increase the insurance premium. When this happened

only a small percentage of people could afford a good insurance premium. The increas of the insurance premium also due to the lack of security system installed to the car.

The car manufacturers installed a minimum standard security system such as an alarm-based security system. However, this device is not effective enough. It does not have any pager system attached to it. The car thief takes only a few minutes to deactivate the security system. Furthermore, nobody will pay an attention when the car alarm goes off. Based on these reasons, it is proposed that a GSM-based vehicle anti-theft system development is designed and developed to improve the performance of the current vehicle security system.

## 1.3 Objective

The main objective of this project is to design, construct and test a GSM-based vehicle anti-theft system that can be used to improve the performance of car immobiliser system and car security alarm system. When either the immobiliser or the alarm is activated, the proposed system will activate its voice-based alarm and at the same time send a signal to the user's cellular phone, informing the user the current status of the car. The proposed system also allows the user to lock and unlock the car door remotely using the cellular phone.

In order to achieve the objectives of the project, the following works were carried out.

1. Design and develop the hardware of the proposed system.
2. Develop a control program of the proposed system.

3. Design and develop voice-based car security alarm system.
4. Conduct appropriate tests for the proposed system.

## 1.4 Thesis Layout

The thesis consists of five chapters and its contents can be summarized as follows:

a) Chapter One presents background of the project. It consists of introduction, problem statement and objectives of the project.

b) Chapter Two presents the literature review. This chapter reviews about the car theft, statistic of stolen vehicle, common methods used by thieves to steal cars and options to reduce car theft. It also discusses the previous work used or conducted by other researchers related to the project.

c) Chapter Three presents the design procedures used to develop the hardware and the software of the proposed system.

d) Chapter Four presents results and its discussion taken from various tests conducted for the proposed system.

e) Chapter Five presents the conclusion, recommendations and future improvements that can be introduced to enhance its functionality and usage.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

Car theft is one of the social problems in the society. There are several factors contributing to this problem;

i) The gap between the rich and the poor are getting bigger and higher. Poverty increases everyday at an alarming rate and this will lead to dissatisfaction among people. The easiest way to get money is by committing crime and car theft is one of the crime which gives good return. They, in general do not care about the consequences of the crimes.

ii) Moreover, the law and its enforcement to punish the criminals are not punishable enough.

iii) The current car security system is not effective and the carelessness of the car owner does not help in inhibiting the crimes.

There are many forms of car theft. The types of car theft vary considerably from one country to another, from straight forward unorganized theft for profit on the resale market to well organized groups of criminals stealing on demand for the export market to other countries. This crime was done either by using common tools or brutal force. The locks on the car and current car security system provides little deterrent to a skilled car thief.

Another type of car theft, prevalent predominantly in the United Kingdom, is called "joy-riding" crime which is normally done by teenagers, for the sheer destructive pleasure of driving at high speed with complete disregard to the law, sometimes causing fatal injuries to innocent bystanders and even the criminals in the stolen cars as well. It is also recognized that joy-riding is the first step on the ladder of professional theft [1].

Furthermore, car theft could also be grouped as; theft "from" the vehicle and theft "of" the vehicle. Theft "from" vehicle means that the thief would only takes personal items, parts and accessories from the vehicles. The second group called theft "of" the vehicle consists of professional theft who stole the car for parts and accessories dismantling, exporting and even changed the identity of the car to be resold in the market. Sometimes, thieves in this would sustain the crime for a short period of time to avoid being suspected.

As the theft rate increases, the customers always have high expectations that an anti-theft protection on their brand new vehicle is to be provided as part of the basic requirements.

### 2.1.1 Statistic of Stolen Car

The statistical data has shown that the number of stolen cars increases steadily year by year. Most of the countries have to face the increasing number of stolen car cases, especially in the United States, where auto theft are among the most common crimes reported. In the USA, approximately 1.5 million vehicles were stolen in 1992. This number is 25% increase from the total cases reported in 1991. In other countries such as France, car theft costs £150 million, resulting from 312,000 stolen vehicles in 1992. Meanwhile, in Germany, in 1992, 120,000 vehicles were stolen and it is reported that the stolen vehicles are being exported to the former East European States [1].

In Malaysia, car theft cases are increasing steadily. The police statistic shows that for the first eight month in year 2003, there are about 4,629 cars reported stolen in Malaysia. It is about 12% increase compared to the same period a year before [2].

The General Insurance Association of Malaysia (PIAM) news release gives statistics of stolen vehicle in year 2001. Proton's model have the highest number of cars reported stolen of that year. The theft of Protons' cars accounts for about 51% of the total 2,436 private cars reported stolen to insurers during this period of time. It means that, on average, about seven Proton cars are reported stolen every day. PIAM statistic further reveals that 4-wheel drive vehicles account for 17% of stolen private car claim and the favorite is the Mitsubishi Pajero. PIAM statistics reveal that vehicle thefts are concentrated in Kuala Lumpur, Selangor and Johor.